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SCHOOL OF OCEANOGRAPHY

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Dr. Janet W. Campbell, Program Manager
Ocean Biology/Biogeochemistry
MTPE/Code YS
NASA HQ
Washington, D.C. 20546

Subject: Final Report for grant NAGW-3606, "Patterns of CZCS-observed plant pigment in regions of ~~present~~ or future JGOFS work, and in the Subarctic Pacific and Bering Sea" to Karl Banse, School of Oceanography, University of Washington, 3/1/93-12/31/95 (Univ. of Washington budget 61-2636)

Dear Janet,

This is, finally, the Final Report for the above 3-yr grant, awarded by NASA on 7/31/95. On 10 September 1995 in a letter to Robert Frouin and on 12 November 1996 in a letter to Jim Yoder I asked for, and was granted, two no-cost extensions. The reason for the extensions was frugal budgeting, and in the second extension principally the need to cover publishing costs. These are ofteny paid for by a continuation grant, but owing to completing my use of CZCS measurements in support of studies in regional oceanography, I chose not to submit a plan and budget for a new project. Since then, with Jim Yoder's help, I have received further publication support (for page charges, color plate, reprints) through JPL.

The proposal abstract of 11/24/92 ran "Observations with the Coastal Zone Color Scanner are to be processed for studying regional and seasonal differences in plant pigment distribution in (1) the Arabian Sea with the adjoining laccadive Sea, (2) parts of the Southern Ocean, (3) the equatorial Pacific, and (4) the subarctic Pacific with the adjoining western Bering Sea. The three first-named seas are presently or soon will be investigated by the Joint Global Ocean Flux Study." I may add now that, as anticipated at the time, region (4) is the focus of a comprehensive study of climate change --> --> fish, coordinated by the North Pacific Marine Science Organization (PICES), and another, independent program under the U.S. GLOBEC.

Since I have submitted progress reports for the grant, I wish to state only that point (3) was dropped after Halpern and Feldman (1994) and Fiedler (1994) essentially had done the job. (Halpern, D. and G.C. Feldman, 1994, Annual and interannual variation of phytoplankton pigment concentration and upwelling along the Pacific equator, J. Geophys. Res. 99 C: 7,347-7,354; Fiedler, P.C., 1994, Seasonal and interannual variability of CZCS phytoplankton pigments and winds in the eastern

tropical Pacific, J. Geophys. Res. 99 C: 18,371- 18,384.) Papers about the other regions have appeared during the grant period or are being prepared as follows. The list includes articles that treat seeming side issues, which were investigated because of knowing that the NASA program managers take a broad view of basic science. Four reprints each of the 1996/1997 papers signified by an * are distributed as prescribed on NASA Form 1463 of Jan. 1992. Earlier papers were submitted previously.

Banse, K. and D.C. English (1994) Revision of satellite-based phytoplankton pigment data from the Arabian Sea during the northeast monsoon. Mar. Res. (Pakistan) 2: 83-103. Also supported by ONR.

Banse, K. (1994) Uptake of inorganic carbon and nitrate by marine plankton and the Redfield Ratio. Global Biogeochem. Cycles 8: 81-84.

Banse, K. (1994) Grazing and zooplankton production as key controls of phytoplankton production in the open ocean. Oceanography 7: 13-20. Also supported by ONR.

Banse, K. (1995) Antarctic marine top predators revisited: homeotherms do not leak much CO2 to the air. Polar Biol. 15: 93-104.

Banse, K. (1996) Low seasonality of low concentrations of surface chlorophyll in the Subantarctic water ring: underwater irradiance, iron, or grazing? Prog. Oceanogr. 37: 165-215. The preceding NASA grant NAGW-1007 to K.B. is also acknowledged.

*English, D.C., K. Banse, M.J. Perry, and D.L. Martin (1996) Electronic overshoot and other bias in the CZCS Global Data Set: comparison with ground truth from the subarctic Pacific. Int. J. Remote Sensing 17: 3157-3168.

*Banse, K. and D.C. English (1997) Near-surface phytoplankton pigment from the Coastal Zone Color Scanner in the Subantarctic region southeast of New Zealand. Mar. Ecol. Prog. Ser. 156: 51-66.

Lierheimer, L.J. (1997) Seasonal and interannual variability of phytoplankton in the laccadive Sea as observed by the Coastal Zone Color Scanner. M. Sci. thesis, School of Oceanography, University of Washington. 74 pp. and appendices. With additional support from university funds.

I plan to edit the thesis and embellish it next year toward a joint paper, with me a junior author, for the Proc. Indian Acad. Sci. (Earth Planetary Sci.), where most of the presumptive readers would be.

Banse, K. (in press) Irregular flow of Persian (Arabian) Gulf water to the Arabian Sea. J. Mar. Res. 55:6 (for 1997). Also supported by ONR.

Banse, K., D.M. Bartolacci, D.C. English and M.E. Luther (submitted) CZCS-derived phytoplankton pigment for 1978-1986 and correlations with physical surface flux fields in the Arabian Sea. Deep-Sea Res. II (for the first volume about the Arabian Sea U.S. JGOFS Process Study). The preceding NASA grant NAGW-1007 to K.B. is also acknowledged, as is the current grant NAGW-3618 to M.E. Luther.

Banse, K. and D.C. English (in preparation) Comparing phytoplankton seasonality in the eastern and western subarctic Pacific and the western Bering Sea.

> The processing, including the preparation of final figures, is completed. A draft of the manuscript is in hand, which also treats the history (or the long blind alley and the methodological reasons for it) of the lack of understanding of the seasonal cycle of primary production in the western subarctic Pacific and the deep parts of the Bering Sea. I plan to complete the manuscript next summer or fall. Presumably, for Mar. Ecol. Prog. Ser.

Banse, K. and J. R. Postel (in preparation) Further observations on sources of variability in satellite-derived estimates of plankton photosynthesis. Presumably, for J. Geophys. Res.-Oceans.

> A next-to-complete ms. has been in hand by now for years, but missing is input by a certain J.W.C. The paper by M.J. Behrenfeld and P.G. Falkowski (1997), Photosynthetic rates derived from satellite-based chlorophyll concentrations, limnol. Oceanogr. 42: 1-20, will permit drastic cuts in the Introduction and Discussion.

In addition during the period, I published papers supported only by ONR.

I continue with my research on regional oceanography based on existing data, mostly from the Arabian Sea, as well as on review articles and the like. I am personally supported by TIAA/CREF and still enjoy nominal ONR funding for drafting, page charges, and one annual meeting.

Finally, let me use also this opportunity for thanking NASA and my former and present program managers very heartily for liberal and fruitful support during more than a decade.

Yours sincerely,

Karl Banse
Professor Emeritus